

CLAIMS

I/We claim:

1. A system for detecting cracks in a part, the system comprising:
a means for conveying the part having a surface for orienting the part;
an illumination source configured to project a sheet of light wherein the sheet of light intersects the part;
an optical system configured to focus reflected light from the sheet of light intersecting the part into an image;
a photosensitive array positioned to receive the image and generate an output corresponding to the image; and
a processor configured to detect cracks in the part by analyzing the output of the photosensitive array.
2. The system according to claim 1, wherein the sheet of light intersecting the part forms a diffuse reflection and the image includes the diffuse reflection.
3. The system according to claim 1, wherein the sheet of light intersects the part across the part's width.
4. The system according to claim 1, wherein the sheet of light is a coherent sheet of light.
5. The system according to claim 4, wherein the illumination source includes a laser diode.
6. The system according to claim 5, wherein the illumination source includes a diffractive beam shaper optically coupled to the laser diode.
7. The system according to claim 5, wherein the illumination source includes a polarizing cube optically coupled to the laser diode.

8. The system according to claim 5, wherein the illumination source includes a half waveplate optically coupled to the laser diode.

9. The system according to claim 1, wherein the illumination source and the photosensitive array are mounted to a reference plate.

10. The system according to claim 9 wherein an angle of the reference plate is adjustable to simultaneously manipulate the angle of the illumination source and the photosensitive array, relative to the part.

11. The system according to claim 1, wherein the illumination source is mounted to a plate having screw settings to adjust the mounting plate relative to the reference plate.

12. The system according to claim 1, wherein the surface for locating the part forms a track for conveying the part.

13. The system according to claim 12, wherein the track is a V-track.

14. The system according to claim 13, wherein the V-track includes a gap configured to allow the sheet of light to intersect the part around the full circumference of the part.

15. The system according to claim 1, wherein the output of the photosensitive array is a digitized image having a plurality of picture elements corresponding to the sheet of light intersecting the part.

16. The system according to claim 15, wherein the processor is configured to identify the plurality of picture elements corresponding to the sheet of light intersecting the part.

17. The system according to claim 16, wherein the processor is configured to determine the presence of cracks by identifying discontinuities in the plurality of picture elements.

18. The system according to claim 17, wherein the processor is configured to determine the presence of cracks by analyzing the spatial relationship of the picture elements.

19. The system according to claim 1, including a position sensor configured to produce a signal when the part is in an inspection position.

20. The system according to claim 19, wherein the imaging device is electronically shuttered to collect a digital image of the part based on the signal from the position sensor.

21. The system according to claim 19, wherein the position sensor has a transmitter and a receiver located at opposite sides of the part.

22. A system for detecting cracks in a part, the system comprising:
a means for conveying the part having a surface for orienting the part;
a plurality of illumination sources configured to project a sheet of light that intersect the part across the part's width thereby forming a diffuse reflection;
a plurality of photosensitive arrays positioned to receive the dissue reflection in the form of an image and generate an output corresponding to the image, wherein each illumination source of the plurality of illumination sources is associated with a photosensitive array from the plurality of photosensitive arrays to form a source-array pair, the source array pairs being arranged around the part to make a continuous measurement around a perimeter of the part; and
a processor configured to detect cracks in the part by analyzing the output of the photosensitive array.

23. The system according to claim 22, wherein the illumination source includes a laser diode, a diffractive beam shaper optically coupled to the laser diode, a polarizing cube optically coupled to the diffractive beam shaper, and a half waveplate optically coupled to the polarizing cube.

24. The system according to claim 22, wherein the plurality of illumination sources and the plurality of photosensitive arrays are mounted to a reference plate and an angle of the reference plate is adjustable to simultaneously manipulate the angle of the illumination source and the photosensitive array, relative to the part.

25. The system according to claim 22, wherein the means for conveying the part is a V-track and the V-track includes a gap configured to allow the sheet of light to intersect the part around the full circumference of the part.

26. The system according to claim 22, wherein the output of the photosensitive array is a digitized image having a plurality of picture elements corresponding to the sheet of light intersecting the part, the processor is configured to identify the plurality of picture elements, and the processor is configured to determine the presence of cracks by identifying discontinuities in the plurality of picture elements.

27. A method for detecting cracks on a part comprising:
projecting a sheet of light onto a part;
imaging the reflected light from the part onto a light sensing array;
digitizing the image from the sensing array;
identifying a plurality of picture elements of the digital image corresponding to the sheet of light intersecting the part; and
determining the presence of cracks on the part by analyzing the spatial relationship of the plurality of picture elements.

28. The system according to claim 27, further comprising determining the presence of cracks by identifying discontinuities in the plurality of picture elements.

29. The method according to claim 28, further comprising sensing the position of the part.

30. The method according to claim 29, further comprising transporting the part along a track.